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Title: MCNP Calculated Efficiency Vs. Measured Efficiency Data
in Q2

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MCNP Calculated Efficiency Vs. Measured Efficiency Data in Q2

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The Radioactive Waste Characterization Team at the Los Alamos National Laboratory's Solid Waste Operations site performs low level and transuranic waste assay and analysis to determine the amount of radionuclides present in the waste. In order to ensure accurate characterization of the waste that comes to the team, detection systems must be thoroughly tested to determine the actual efficiency of the system.

One such detection system is the Q2, a Canberra system that utilizes a set of three high purity germanium detectors. Different types of waste can be characterized using the Q2 system including 55-gallon drums, 30-gallon drums, and 2 cubic foot boxes. The efficiency for this system was first determined using an MCNP model, and then verified experimentally for each waste type. The verification experiments showed that after correction for source attenuation, the MCNP model was successful in predicting the efficiency of the system to within less than 5%.

MCNP CALCULATED EFFICIENCY
VS. MEASURED EFFICIENCY
DATA IN Q2 SYSTEM

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Poster

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Introduction

Characterization involves the identification of waste composition and properties, which is important for proper disposal. The characterization team at LANL's solid waste operations site performs low level and transuranic waste assay and analysis to identify and quantify radionuclides present. This poster examines the efficiency of the Q2 detector system by comparing the measured efficiency to the Monte Carlo Neutral Particle (MCNP) calculated efficiency.

Q2 Detector System

- Canberra Industries product that utilizes an array of three high purity germanium detectors
- Initial Calibration was performed at the Canberra factory for 55-gallon steel drums
- Different waste containers can be characterized
 - 55-gallon poly drums
 - 30-gallon drums (steel and poly)
 - 2 cubic foot boxes
- New efficiencies determined in order to characterize these containers accurately

MCNP Calculated Efficiency

- MCNP is a transport code used to duplicate theoretically a statistical process (i.e. the interaction of nuclear particles with materials)
- Q2 detection efficiency for all containers calculated using MCNP
- MCNP calculations were performed independently by Eberline Services

Calculating the Efficiency

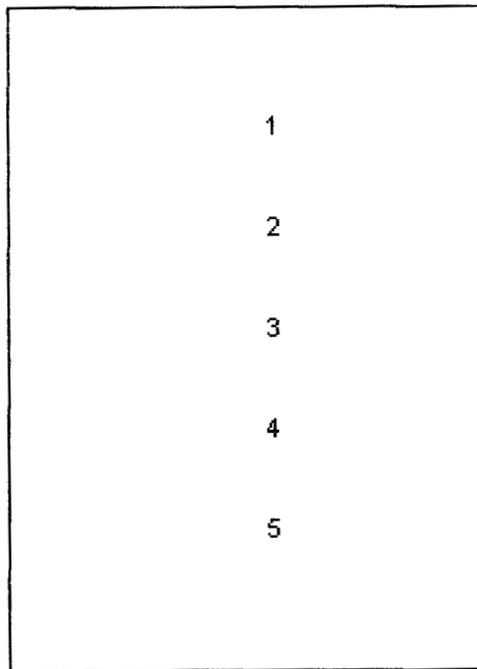
- Am-241, Eu-152, and Ba-133 sources placed in container
- 25 different measurements performed for each container
- Counts from each measurement organized and weighted based on source position
- Absolute efficiency (counts/gamma) calculated and compared to MCNP values

Results

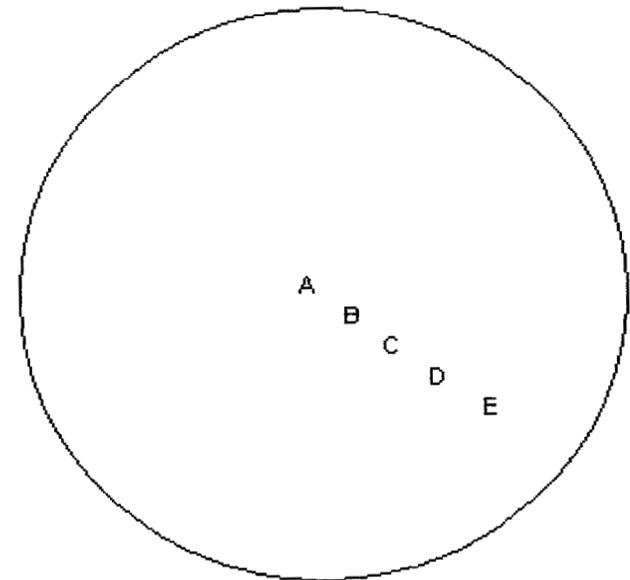
- Source attenuation may not have been accounted for in MCNP model
- The difference between the MCNP calculated efficiency and the measured efficiency appear to be minimal

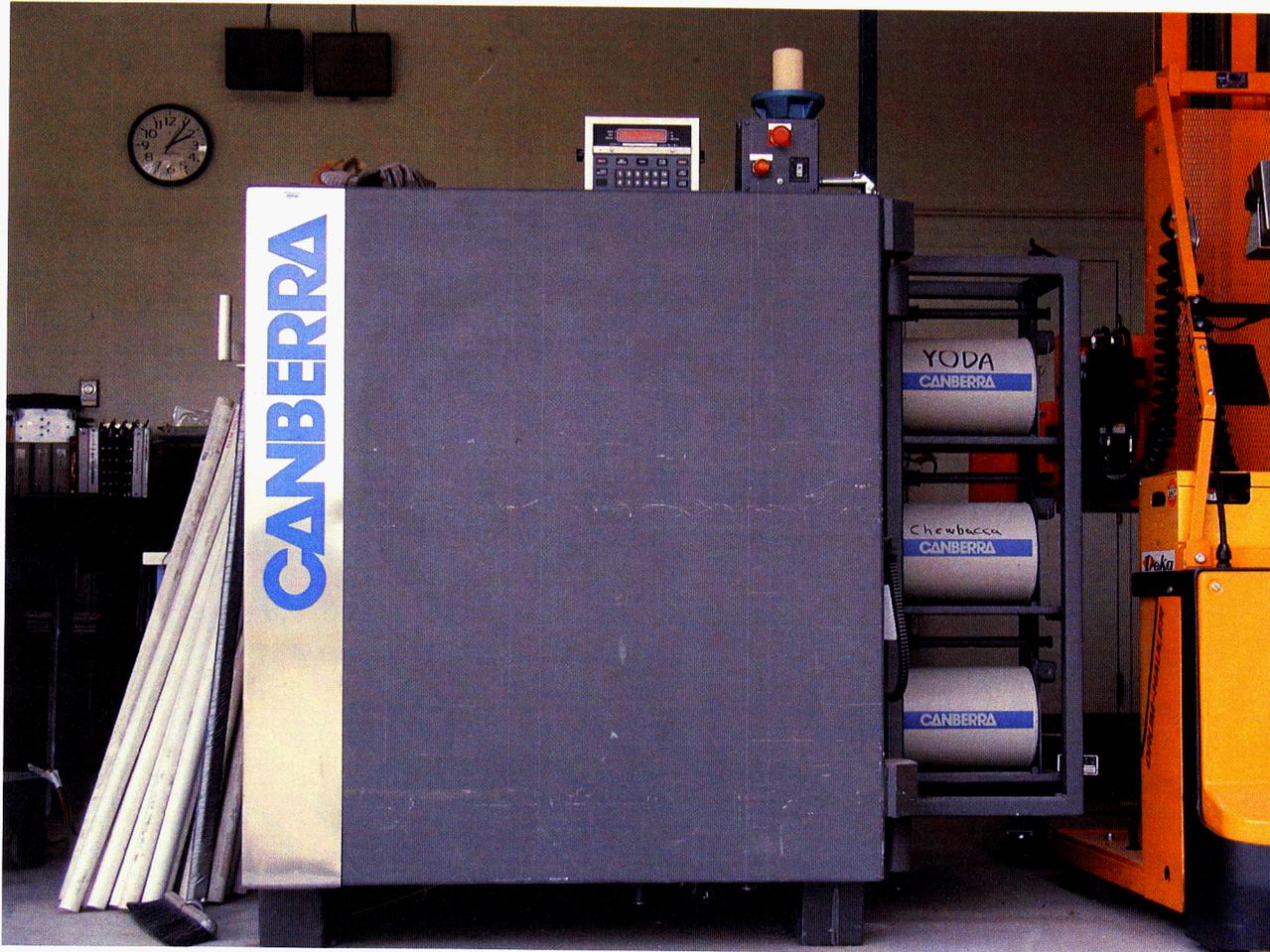
Source Positions

Side View:



Top View:





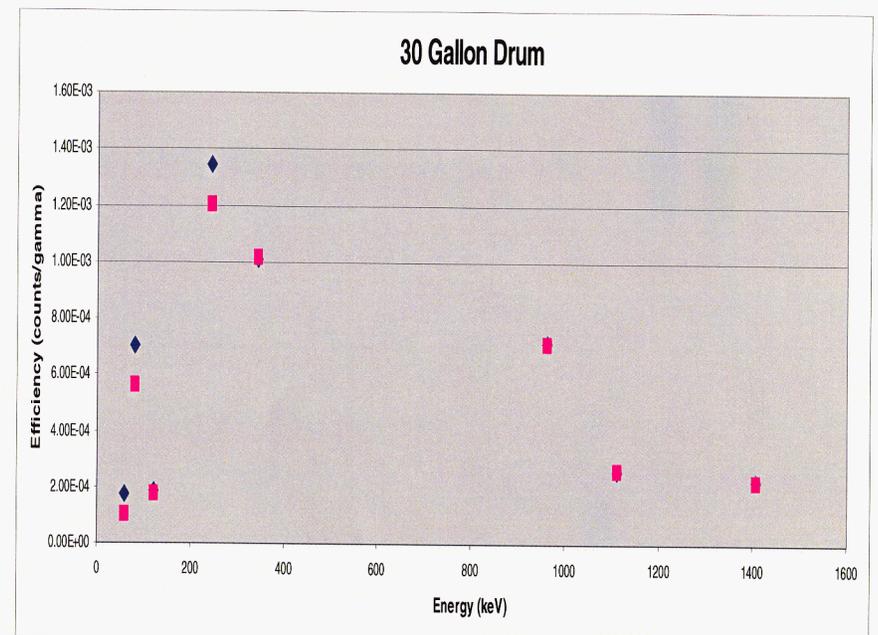
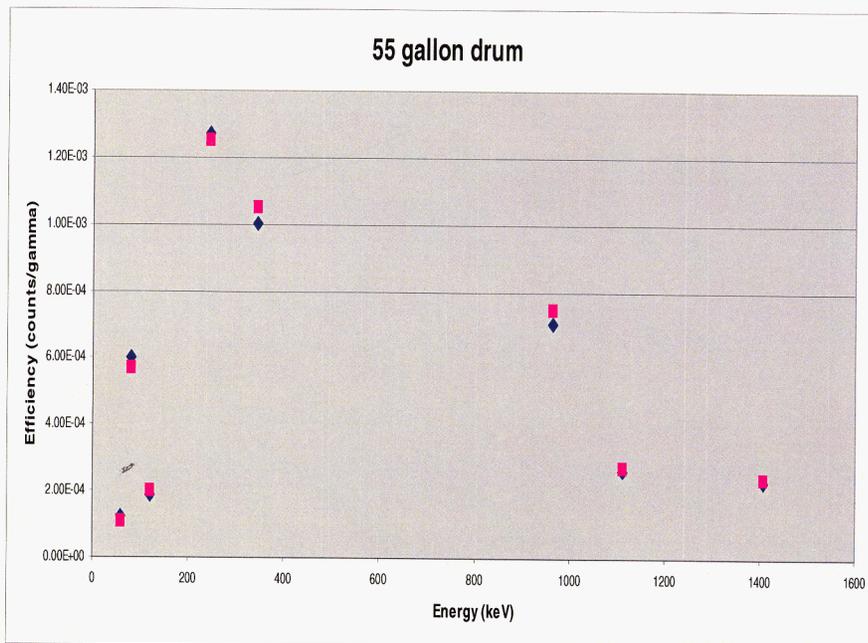
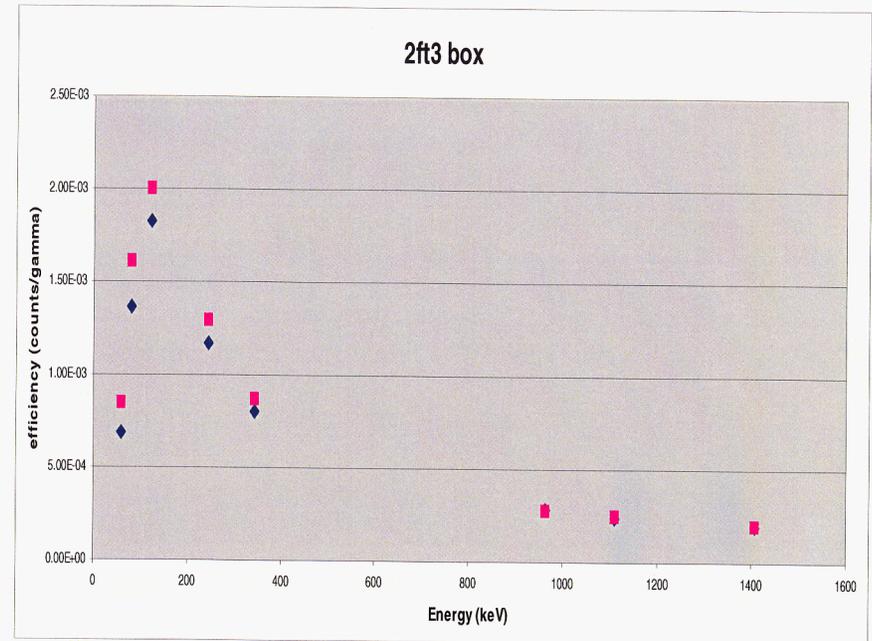
Q2

- “The Force” detectors
- Open chamber for waste containers



MCNP vs. Measured Efficiency

◆ Measured Efficiency
■ MCNP Efficiency



Percent Difference

